12-13 Nov 2014 Isotope S&T Review - Homework

1. **What are the approximate costs per week of each of the five presented modes of BLIP operation (slide 7 of Thomas Roser's presentation)?** *(P. Pile)*

2. How do the 2013 and 2014 costs compare to budget allocations (slide 38 of Suzanne Smith's first presentation)?

3. Provide a list of peer-reviewed publications since the last program review.

4. Provide worker dose data for the last 3 years.

5. Provide two examples of procedure changes and identify how integrated safety management/integrated work management were applied to those changes.

5 Distinct Operating/Cost Modes for BLIP Operations

Mode	Description	Cost Algorithm
1	Dedicated Running	BLIP assumes all start-up and operating costs including operators needed in MCR
2	RHIC Polarized Proton Running	BLIP runs continuously. Higher tube currents for BLIP increase tube replacement component of the rate. Linac start up cost paid by RHIC
3	NSRL Running with Tandem or EBIS	NSRL runs 12 hour day shift/no weekends. BLIP assumes all start-up costs, overnight and weekend operating costs.
4	NSRL Running with Linac in parallel with RHIC pp Setup	NSRL runs 12 hour day shift/no weekends. BLIP assumes all overnight and (if appropriate) weekend operating costs. Linac start up costs paid by RHIC.
5	RHIC Heavy Ion Running	BLIP pays dedicated costs associated with Linac operations and tube use. RHIC Program pays MCR labor cost.

- In addition to modes, costs also vary with Linac energy used.
- Consider to have cost also depend on Linac beam intensity since Linac tube failures increase with beam intensity
- RHIC maintains a five-year inventory of Linac tubes to be able to respond to the single vender going out-of-business. The present inventory is larger than needed for RHIC alone. The extra inventory should be maintained by the isotope program.

BLIP Rate Components by Operating Mode

Mode	Description	Power	Tube Replacement	Linac Maintenance	MCR Labor
1	Dedicated Running	Power use estimated for each of 4 operating energy levels. BNL balanced billing power rates utilized.	Weekly cost of tube usage based on purchase history and estimated hourly lifetime by tube for each of 6 tube types. Number of tubes in use varies by type for each of 4 operating energy levels. Modes 2 and 4 share cost of tubes with RHIC.	40 hours per week for technical support. Misc trade labor and materials based on historical data for Linac maintenance	168 hours per week for Main Control Room Operator
2	RHIC Polarized Protons			Paid by RHIC Program	Paid by RHIC Program
3	NSRL with Tandem			40 hours per week for technical support. Misc trade labor and materials based on historical data for Linac maintenance	112 hours per week for Main Control Room Operator
4	NSRL with Linac			40 hours per week for technical support. Misc trade labor and materials based on historical data for Linac maintenance	56 hours per week for Main Control Room Operator
5	RHIC Heavy Ions			Paid by RHIC Program	Paid by RHIC Program

2014 BLIP Operating Cost Worksheet											
Q:\BLIP & Isotope Program\FY14\[BLIP Beam Cost Worksheet FY14-Final.xls]SUMMARY SHEET											
		Power rate @ $62/MwH			October 2013 - December 2013						
								(includes G&A)	(includes G&A)	(includes G&A)	
Operating Mode:				POWER	POWER	Maintenance	Operations	Total Weekly		Start-up	
			MW	$/MWH	Cost/Week	wage&mat'l	Support	Cost	hourly cost	Cost	
Dedicated Running, RHIC in "stand by"(1)		200MeV OPS	2.19	62	22,851	95,512	21,204	139,567	830.75	212,687	
		139MeV OPS	1.69	62	17,560	78,730	21,204	117,494	699.37	186,090	
		116MeV OPS	1.53	62	15,953	73,136	21,204	110,293	656.50	177,872	
		90MeV OPS	1.36	62	14,158	67,542	21,204	102,904	612.52	168,961	
		66MeV OPS	1.19	62	12,363	61,948	21,204	95,515	568.54	160,050	
(1) BLIP assumes all operating costs including a 6 operator shift rotation in the MCR.											
RHIC Polarized Proton Running (2)		200MeV OPS	0.51	62	5,344	49,751	-	55,096	327.95	-	
		181MeV OPS	0.49	62	5,075	44,437	-	49,512	294.71	-	
		139MeV OPS	0.46	62	4,813	33,808	-	38,622	229.89	-	
		116MeV OPS	0.44	62	4,547	28,494	-	33,041	196.67	-	
		90MeV OPS	0.40	62	4,150	23,180	-	27,330	162.68	-	
		66MeV OPS	0.29	62	3,053	17,865	-	20,919	124.52	-	
(2) assumes BLIP runs during RHIC fill and higher tube currents required for BLIP adversely affect tube lifetime compared to ^PProtons running only.											
NSRL Running Only (3)		200MeV OPS	2.19	62	22,851	95,512	14,136	132,499	788.68	212,687	
		116MeV OPS	1.53	62	15,953	73,136	14,136	103,225	614.43	177,872	
		90MeV OPS	1.36	62	14,158	67,542	14,136	95,836	570.45	168,961	
		66MeV OPS	1.19	62	12,363	61,948	14,136	88,447	526.47	160,050	
(3)-assumes that NSRL runs for 12 hour daytime shift and no weekends. Blip covers overnight and all weekend shift coverage.											
NSRL Running Only - No BLIP Weekends (4)		200MeV OPS	2.19	62	21,164	76,135	7,068	104,367	621.23	-	
PP Set-up for RHIC pays start-up cost		116MeV OPS	1.53	62	14,775	62,039	7,068	83,882	499.30	-	
		90MeV OPS	1.36	62	13,113	58,514	7,068	78,695	468.42	-	
		66MeV OPS	1.19	62	11,451	54,990	7,068	73,509	437.55	-	
(4)-assumes that NSRL runs for 12 hour daytime shift and no weekends. Blip covers weekday overnight and Linac is put in save-a-watt for the weekend.											
RHIC Heavy Ion Running (5)		200MeV OPS	2.19	62	22,851	95,512	-	118,363	704.54	212,687	
		181MeV OPS	2.03	62	21,150	89,918	-	111,068	661.12	203,912	
		139MeV OPS	1.69	62	17,560	78,730	-	96,290	573.16	186,090	
		116MeV OPS	1.53	62	15,953	73,136	-	89,089	530.29	177,872	
		90MeV OPS	1.36	62	14,158	67,542	-	81,700	486.31	168,961	
		66MeV OPS	1.19	62	12,363	61,948	-	74,311	442.33	160,050	
(5)-Blip pays all additional dedicated costs associated with Linac operations and tube wear and tear.											

2014 BLIP Operating Cost Worksheet										
N:\BLIP & Isotope Program\FY14\[BLIP Beam Cost Worksheet FY14-Final after rate increase.xls]Summary Scenarios										
		Power rate @ $56/MwH			January 2014 - February 2014					
								(includes G&A)	(includes G&A)	(includes G&A)
Operating Mode:				POWER	POWER	Maintenance	Operations	Total Weekly		Start-up
			MW	$/MWH	Cost/Week	wage&mat'l	Support	Cost	hourly cost	Cost
Dedicated Running, RHIC in "stand by"(1)		200MeV OPS	2.19	56	20,639	95,512	21,204	137,355	817.59	200,841
		139MeV OPS	1.69	56	15,861	78,730	21,204	115,795	689.25	176,818
		116MeV OPS	1.53	56	14,409	73,136	21,204	108,749	647.31	169,396
		90MeV OPS	1.36	56	12,788	67,542	21,204	101,534	604.37	161,347
		66MeV OPS	1.19	56	11,167	61,948	21,204	94,319	561.42	153,298
(1) BLIP assumes all operating costs including a 6 operator shift rotation in the MCR.										
RHIC Polarized Proton Running (2)		200MeV OPS	0.51	56	4,827	49,751	-	54,579	324.87	-
		181MeV OPS	0.49	56	4,584	44,437	-	49,021	291.79	-
		139MeV OPS	0.46	56	4,347	33,808	-	38,156	227.12	-
		116MeV OPS	0.44	56	4,107	28,494	-	32,601	194.05	-
		90MeV OPS	0.40	56	3,749	23,180	-	26,928	160.29	-
		66MeV OPS	0.29	56	2,758	17,865	-	20,623	122.76	-
(2) assumes BLIP runs during RHIC fill and higher tube currents required for BLIP adversely affect tube lifetime compared to ^PProtons running only.										
NSRL Running Only (3)		200MeV OPS	2.19	56	20,639	95,512	14,136	130,287	775.52	200,841
		116MeV OPS	1.53	56	14,409	73,136	14,136	101,681	605.24	169,396
		90MeV OPS	1.36	56	12,788	67,542	14,136	94,466	562.30	161,347
		66MeV OPS	1.19	56	11,167	61,948	14,136	87,251	519.35	153,298
(3)-assumes that NSRL runs for 12 hour daytime shift and no weekends. Blip covers overnight and all weekend shift coverage.										
NSRL Running Only - No BLIP Weekends (4)		200MeV OPS	2.19	56	19,116	76,135	7,068	102,319	609.04	-
PP Set-up for RHIC pays start-up cost		116MeV OPS	1.53	56	13,345	62,039	7,068	82,452	490.79	-
		90MeV OPS	1.36	56	11,844	58,514	7,068	77,426	460.87	-
		66MeV OPS	1.19	56	10,342	54,990	7,068	72,401	430.96	-
(4)-assumes that NSRL runs for 12 hour daytime shift and no weekends. Blip covers weekday overnight and Linac is put in save-a-watt for the weekend.										
RHIC Heavy Ion Running (5)		200MeV OPS	2.19	56	20,639	95,512	-	116,152	691.38	200,841
		181MeV OPS	2.03	56	19,103	89,918	-	109,021	648.94	192,915
		139MeV OPS	1.69	56	15,861	78,730	-	94,591	563.04	176,818
		116MeV OPS	1.53	56	14,409	73,136	-	87,545	521.10	169,396
		90MeV OPS	1.36	56	12,788	67,542	-	80,330	478.16	161,347
		66MeV OPS	1.19	56	11,167	61,948	-	73,115	435.21	153,298
(5)-Blip pays all additional dedicated costs associated with Linac operations and tube wear and tear.										

2014 BLIP Operating Cost Worksheet										
N:\BLIP & Isotope Program\FY14\[BLIP Beam Cost Worksheet FY14-Final after rate increase.xls]SUMMARY SHEET										
		Power rate @ $62/MwH			March 2014 - May 2014					
Operating Mode:			MW	POWER $/MWH	POWER Cost/Week	Maintenance wage&mat'l	Operations Support	(includes G&A) Total Weekly Cost	(includes G&A) hourly cost	(includes G&A) Start-up Cost
Dedicated Running, RHIC in "stand by"(1)		200MeV OPS	2.19	62	22,851	95,512	21,204	139,567	830.75	212,687
		139MeV OPS	1.69	62	17,560	78,730	21,204	117,494	699.37	186,090
		116MeV OPS	1.53	62	15,953	73,136	21,204	110,293	656.50	177,872
		90MeV OPS	1.36	62	14,158	67,542	21,204	102,904	612.52	168,961
		66MeV OPS	1.19	62	12,363	61,948	21,204	95,515	568.54	160,050
(1) BLIP assumes all operating costs including a 6 operator shift rotation in the MCR.										
RHIC Polarized Proton Running (2)		200MeV OPS	0.51	62	5,344	49,751	-	55,096	327.95	-
		181MeV OPS	0.49	62	5,075	44,437	-	49,512	294.71	-
		139MeV OPS	0.46	62	4,813	33,808	-	38,622	229.89	-
		116MeV OPS	0.44	62	4,547	28,494	-	33,041	196.67	-
		90MeV OPS	0.40	62	4,150	23,180	-	27,330	162.68	-
		66MeV OPS	0.29	62	3,053	17,865	-	20,919	124.52	-
(2) assumes BLIP runs during RHIC fill and higher tube currents required for BLIP adversely affect tube lifetime compared to ^PProtons running only.										
NSRL Running Only (3)		200MeV OPS	2.19	62	22,851	95,512	14,136	132,499	788.68	212,687
		116MeV OPS	1.53	62	15,953	73,136	14,136	103,225	614.43	177,872
		90MeV OPS	1.36	62	14,158	67,542	14,136	95,836	570.45	168,961
		66MeV OPS	1.19	62	12,363	61,948	14,136	88,447	526.47	160,050
(3)-assumes that NSRL runs for 12 hour daytime shift and no weekends. Blip covers overnight and all weekend shift coverage.										
NSRL Running Only - No BLIP Weekends (4)		200MeV OPS	2.19	62	21,164	76,135	7,068	104,367	621.23	-
PP Set-up for RHIC pays start-up cost		116MeV OPS	1.53	62	14,775	62,039	7,068	83,882	499.30	-
		90MeV OPS	1.36	62	13,113	58,514	7,068	78,695	468.42	-
		66MeV OPS	1.19	62	11,451	54,990	7,068	73,509	437.55	-
(4)-assumes that NSRL runs for 12 hour daytime shift and no weekends. Blip covers weekday overnight and Linac is put in save-a-watt for the weekend.										
RHIC Heavy Ion Running (5)		200MeV OPS	2.19	62	22,851	95,512	-	118,363	704.54	212,687
		181MeV OPS	2.03	62	21,150	89,918	-	111,068	661.12	203,912
		139MeV OPS	1.69	62	17,560	78,730	-	96,290	573.16	186,090
		116MeV OPS	1.53	62	15,953	73,136	-	89,089	530.29	177,872
		90MeV OPS	1.36	62	14,158	67,542	-	81,700	486.31	168,961
		66MeV OPS	1.19	62	12,363	61,948	-	74,311	442.33	160,050
(5)-Blip pays all additional dedicated costs associated with Linac operations and tube wear and tear.										

2014 BLIP Operating Cost Worksheet										
N:\BLIP & Isotope Program\FY14\[BLIP Beam Cost Worksheet FY14-Final after rate increase.xls]Summary Scenarios										
		Power rate @ $74/MwH			June 2014 - September 2014					
								(includes G&A)	(includes G&A)	(includes G&A)
Operating Mode:				POWER	POWER	Maintenance	Operations	Total Weekly		Start-up
			MW	$/MWH	Cost/Week	wage&mat'l	Support	Cost	hourly cost	Cost
Dedicated Running, RHIC in "stand by"(1)		200MeV OPS	2.19	74	27,273	95,512	21,204	143,989	857.08	236,379
		139MeV OPS	1.69	74	20,959	78,730	21,204	120,893	719.60	204,634
		116MeV OPS	1.53	74	19,040	73,136	21,204	113,380	674.88	194,826
		90MeV OPS	1.36	74	16,898	67,542	21,204	105,644	628.83	184,190
		66MeV OPS	1.19	74	14,756	61,948	21,204	97,908	582.79	173,554
(1) BLIP assumes all operating costs including a 6 operator shift rotation in the MCR.										
RHIC Polarized Proton Running (2)		200MeV OPS	0.51	74	6,379	49,751	-	56,130	334.11	-
		181MeV OPS	0.49	74	6,057	44,437	-	50,494	300.56	-
		139MeV OPS	0.46	74	5,745	33,808	-	39,553	235.44	-
		116MeV OPS	0.44	74	5,427	28,494	-	33,921	201.91	-
		90MeV OPS	0.40	74	4,953	23,180	-	28,133	167.46	-
		66MeV OPS	0.29	74	3,644	17,865	-	21,510	128.03	-
(2) assumes BLIP runs during RHIC fill and higher tube currents required for BLIP adversely affect tube lifetime compared to ^PProtons running only.										
NSRL Running Only (3)		200MeV OPS	2.19	74	27,273	95,512	14,136	136,921	815.01	236,379
		116MeV OPS	1.53	74	19,040	73,136	14,136	106,312	632.81	194,826
		90MeV OPS	1.36	74	16,898	67,542	14,136	98,576	586.76	184,190
		66MeV OPS	1.19	74	14,756	61,948	14,136	90,840	540.71	173,554
(3)-assumes that NSRL runs for 12 hour daytime shift and no weekends. Blip covers overnight and all weekend shift coverage.										
NSRL Running Only - No BLIP Weekends (4)		200MeV OPS	2.19	74	25,260	76,135	7,068	108,464	645.62	-
PP Set-up for RHIC pays start-up cost		116MeV OPS	1.53	74	17,635	62,039	7,068	86,741	516.32	-
		90MeV OPS	1.36	74	15,651	58,514	7,068	81,233	483.53	-
		66MeV OPS	1.19	74	13,667	54,990	7,068	75,725	450.74	-
(4)-assumes that NSRL runs for 12 hour daytime shift and no weekends. Blip covers weekday overnight and Linac is put in save-a-watt for the weekend.										
RHIC Heavy Ion Running (5)		200MeV OPS	2.19	74	27,273	95,512	-	122,786	730.87	236,379
		181MeV OPS	2.03	74	25,243	89,918	-	115,161	685.48	225,906
		139MeV OPS	1.69	74	20,959	78,730	-	99,689	593.39	204,634
		116MeV OPS	1.53	74	19,040	73,136	-	92,177	548.67	194,826
		90MeV OPS	1.36	74	16,898	67,542	-	84,440	502.62	184,190
		66MeV OPS	1.19	74	14,756	61,948	-	76,704	456.57	173,554
(5)-Blip pays all additional dedicated costs associated with Linac operations and tube wear and tear.										

FY 2014 BLIP Cost Estimate

FY 2014 BLIP LINAC Operations Cost Estimate (not actuals but my estimate)								
							S. Smith Presentation	
Dates		weeks	Mode	Energy (MeV)	Cost/hour	Total	Slide 38 (CM actual cost)	
17-Dec-13	31-Dec-13	2.0	pp	116	$ 196.67	$ 66,081		
1-Jan-14	28-Feb-14	8.4	pp	116	$ 194.05	$ 274,775		
1-Mar-14	31-Mar-14	4.4	pp	116	$ 196.67	$ 146,322		
1-Apr-14	31-May-14	8.7	HI	116	$ 530.29	$ 776,345		
1-Jun-14	4-Jul-14	4.9	HI	116	$ 548.67	$ 447,715		
5-Jul-14	31-Jul-14	3.7	Dedicated	116	$ 674.88	$ 421,125		
Sub Total		**32.1**				**$ 2,132,363**		
~Incremental cost for 140-200 MeV		**4**		**200**	**$ 120.00**	**$ 80,640**		
Grand Total						**$ 2,213,003**	**$ 2,303,173**	